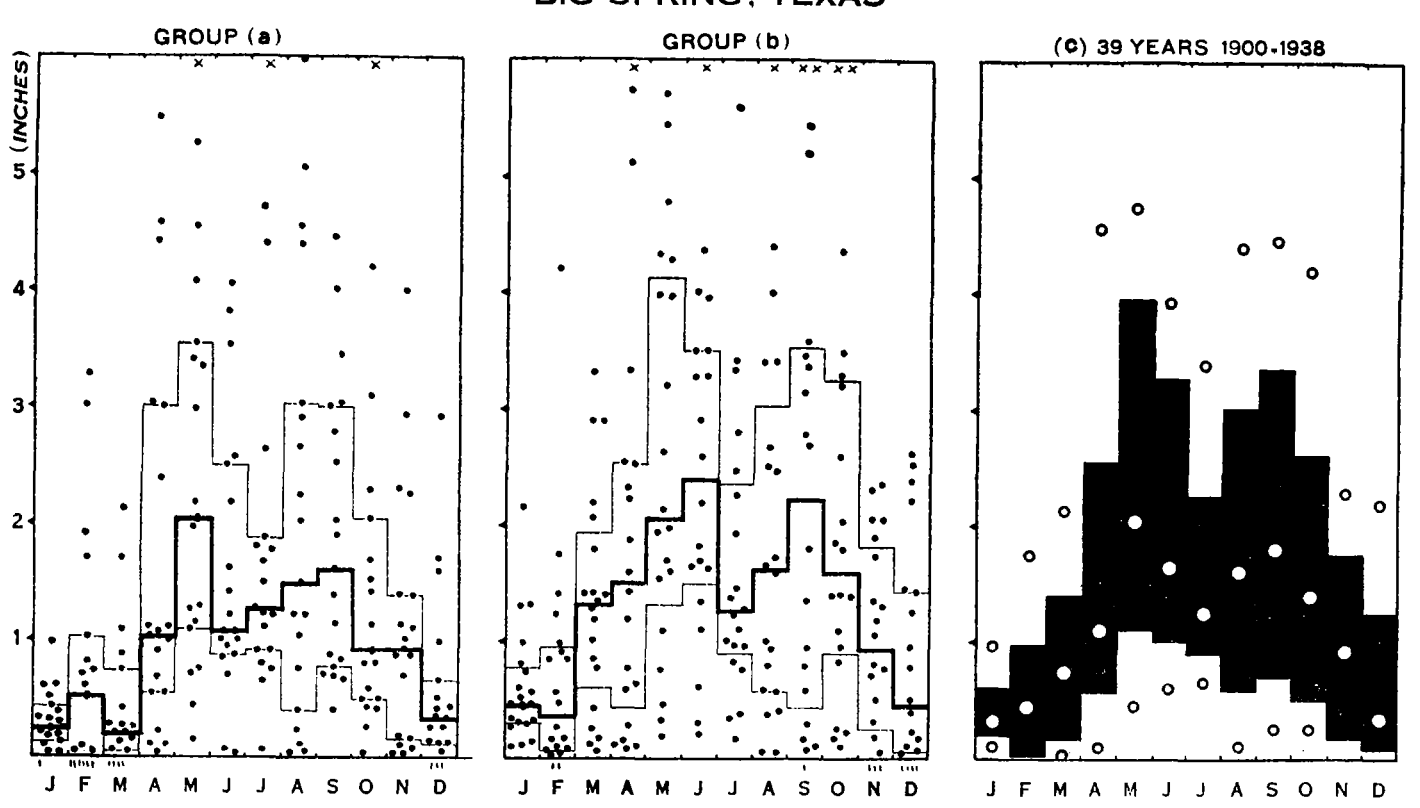

FIGURE 7.

CONCLUSION

We have thus made out the required prima facie case for the existence of a "dual" or "alternating" rainfall regime at Roswell and Carlsbad, New Mexico, and have indicated the lines along which similar comparisons might be instituted for stations in other parts of the world.

The theoretical interest of the conclusion lies both in its implications regarding the concept of "normality," and in the light thrown upon the nature of rainfall transitions. The border between what we have called the Plains and Plateau types of regime is not an amorphous fringe some 250 miles in width, such as the analysis of means would seem to indicate. In any particular year its width is very materially less than this but it is a front which swings widely from year to year. As the records for stations between those used above become long enough to be of value, further information regarding the nature of this front and its migrations should come to hand.

On the practical side it is to be noticed that there is no indication of a regular cycle of years. Forecasting the type of rainfall year to be anticipated will amost certainly involve an understanding of the mechanisms which are operating to produce it (6). The key to successful forecast may therefore lie, not in the study of rainfall data, but in analysis of one of the other climatological elements. Our present task has been to present the facts and state the problem.

NOTES AND REFERENCES

1. In "Geographical Review" 1936, p. 484.
2. All of these, except Big Spring, have records extending over the full period 1895–1938. The record at Big Spring begins in 1900, i. e. it is 5 years short.
3. Since the most striking discontinuity encountered is that from June to July in the Plateau province. The contrast May–June to July–August should indeed be still more vigorous.
4. Also note that in 1916 the Roswell curve differs from both of the others although these are similar one to the other. A heavy local fall in August seems to have caused this anomaly.
5. The Roswell record of 44 years seems rather short for a three-fold division, even if this were thought advisable upon theoretical grounds.
6. Except insofar as *March* values at Roswell may be taken as giving an indication of the kind of rainfall year that is to follow. The method may thus hint at unexpected correlations. It will not establish them.

PRELIMINARY REPORT ON TORNADOES IN THE UNITED STATES DURING 1940

By J. P. KOHLER

[Weather Bureau, Washington, March 3, 1941]

The present study is based largely on the data contained in the tables entitled "Severe Local Storms" appearing in the issues of the MONTHLY WEATHER REVIEW during 1940. A final and more detailed study will appear in the *United States Meteorological Yearbook, 1940*. The figures here are substantially correct; however, it must be remembered that all are subject to change after the final study mentioned above.

The frequency of tornadoes during the year 1940 was considerably below normal, namely, 105 as against the 25-year average of 141. Table 1 shows that tornadoes occurred in 24 States, occasioned 50 deaths, injured more than 577 individuals and caused property damage estimated at $7,350,000.

Table 1 enumerates tornado frequency, deaths, injuries, and damage figures by States during the year. An examination of this table shows that the greatest number of tornadoes occurred during the months of March and April, with a total of 42 storms. The month of June ranked second in order, with 14 disturbances; and, in the months

of July and August, 10 storms per month were reported.

The greatest loss of life from tornadoes occurred in May, when 31 deaths were reported. There were 26 deaths in June, 23 in April, 16 in March and in the remaining months, the mortality rate was considerably less, generally in the order of 1 to 8.

Practically all of the total property losses, approximately $7,350,000, occurred in February; one single disturbance incurred the loss of more than $5,000,000. The most outstanding instance of destructive tornado action took place at Albany, Ga., at 4:20 a. m., on February 10. The loss of life, 17, was surprisingly small considering the fact that the path of the tornado demolished residences and business buildings over an area nearly a quarter of a mile in width and fully a mile and a half in length, beginning at the southern edge of the city and continuing without interruption northeastward through the central business district. Destruction affected 32 city blocks of which 10 blocks consisted of stores, warehouses, hotels, and other commercial buildings, mostly of brick construction. Three hundred persons were treated for injuries and about 1,000 people rendered homeless by the destruction of their dwellings. The total estimated damage was placed at $5,000,000.

In the event that the possible tornadoes enumerated in table 2 are later adjudged to have been true tornadoes, the 1940 figures will be 115 tornadoes, 60 deaths, 630 injured and property losses exceeding $9,477,000.

TABLE 1.—*Tornadoes and probably tornadoes*

State	January	February	March	April	May	June	July	August	September	October	November	December	Year
Alabama:													
Number	1	0	1	1	0	0	0	0	0	0	0	[1] 1	4
Deaths	1		0	0								0	3
Injuries	12		30	0								1	43
Damage ($X-1,000)	5.0		20.0	5.0								[14]	[15] 30.0
Arkansas:													
Number	0	0	0	1	1	0	0	0	0	0	0	0	2
Deaths				6	0								6
Injuries				9	0								9
Damage ($X-1,000)				8.0	5.0								13.0
California:													
Number	0	0	1	0	0	0	0	0	0	0	0	0	1
Deaths			0										0
Injuries			0										0
Damage ($X-1,000)			[2]										[15]
Colorado:													
Number	0	0	0	0	1	0	0	0	0	0	0	0	1
Deaths					0								0
Injuries					0								0
Damage ($X-1,000)					[3]								[15]
Florida:													
Number	0	0	0	0	0	0	0	1	0	0	0	5	6
Deaths								0				0	0
Injuries								0				[4] 2	[15] 2
Damage ($X-1,000)								1.5				[5]	[15] 1.5
Georgia:													
Number	0	1	0	0	0	0	0	0	0	0	0	0	1
Deaths		17											17
Injuries		[4] 300											[15] 300
Damage ($X-1,000)		5,000.0											5,000.0
Idaho:													
Number	0	0	0	1	0	0	0	0	0	0	0	0	1
Deaths				0									0
Injuries				0									0
Damage ($X-1,000)				25.0									25.0
Illinois:													
Number	0	0	4	[6] 3	0		[0] 0	0	0		[0] 0	0	[15] 7
Deaths			1	2									3
Injuries			8	[7] 20									[15] 28
Damage ($X-1,000)			280.0	285.0									565.0
Indiana:													
Number	0	0	2	0	0	0	0	0	0	0	0	0	2
Deaths			1										1
Injuries			24										24
Damage ($X-1,000)			160.0										160.0

TABLE 1.—*Tornadoes and probable tornadoes*—Continued

State	January	February	March	April	May	June	July	August	September	October	November	December	Year
Iowa:													
Number	0	0	2	0	0	4	2	0	0	0	1	0	9
Deaths			0			0	0				0		0
Injuries			1			1	25				0		27
Damage ($X-1,000)			[8] 25.0			[8] 7.0	101.5				3.0		[15] 136.5
Kansas:													
Number	0	0	0	3	1	3		3	1	0	0	0	11
Deaths				0	0	0		0	0				0
Injuries				0	0	0		0	0				0
Damage ($X-1,000)				4.0	[9]	107.0		13.5	[9]				[15] 24.5
Louisiana:													
Number	0	1	4	6	0	2	0	0	1	0	0	2	16
Deaths		0	7	6		0			1			0	14
Injuries		0	62	31		1			[11]			4	[15] 98
Damage ($X-1,000)		3.0	60.3	524.8		6.5			6.0			12.0	612.6
Mississippi:													
Number	0	0	3	0	0	0	0	0	2	0	1	0	6
Deaths			0						1		0		1
Injuries			13						[11]		7		[15] 20
Damage ($X1,000)			22.0						33.0		200.0		255.0
Montana:													
Number	0	0	0	0	0	0	1	0	0	0	0	0	1
Deaths							0						0
Injuries							0						0
Damage ($X1,000)							[12]						[13]
Nebraska:													
Number	0	0	0	3	0	3	3	0	0	0	0	0	9
Deaths				0		0	0						0
Injuries				2		0	0						2
Damage ($X1,000)				47.0		24.5	17.0						88.5
New Mexico:													
Number	0	0	0	0	0	0	1	0	0	0	0	0	1
Deaths							0						0
Injuries							0						0
Damage ($X1,000.)							[13]						[15]
North Carolina:													
Number	0	0	0	1	0	0	0	1	0	0	0	0	2
Deaths				0				0					0
Injuries				1				0					1
Damage ($X1,000).				[8]				[5]					[15]
Oklahoma:													
Number	0	0	0	0	2	0	0	2	0	1	0	0	5
Deaths					0			0		0			0
Injuries					4			0		1			5
Damage ($X1,000)					25.2			17.2		10.0			52.4
Pennsylvania:													
Number	0	0	0	0	1	0	0	0	0	0	0	0	1
Deaths					0								0
Injuries					1								1
Damage ($X1,000)					[14]								[15]
South Carolina:													
Number	0	0	0	0	1	0	0	1	0	0	0	0	2
Deaths					0			0					0
Injuries					0			0					0
Damage ($X1,000)					3.0			2.0					5.0
South Dakota:													
Number	0	0	0	0	0	0	3	1	0	0	0	0	4
Deaths							0	0					0
Injuries							0	0					0
Damage ($X1,000)							[10] 5.0	53.0					[15] 58.0
Tennessee:													
Number	0	0	1	0	0	0	0	0	0	0	1	0	2
Deaths			0								0		0
Injuries			[4] 15								[11]		[15] 15
Damage ($X1,000)			28.0								160.0		188.0
Texas:													
Number	0	0	3	2	2	0	0	1	0	[1] 1	0	0	9
Deaths			0	3	0			0		0			3
Injuries			0	0	0			0		0			0
Damage ($X1,000)			[8] 25.0	103.5	[8]			0.5		[2]			[15] 129.0
Wisconsin:													
Number	0	0	0	0	0	2	0	0	0	0	0	0	2
Deaths						2							2
Injuries						[4] 3							[15] 3
Damage ($X1,000)						6.0							6.0
United States:													
Number	1	2	21	21	9	14	10	10	4	2	3	8	105
Normal frequency	3	4	16	23	31	26	12	7	8	3	5	3	141
Deaths	3	17	9	17		2			2				50
Injuries	12	300	153	63	5	5	25				7	7	577
Damage ($X1,000).	5.0	5,003.0	620.3	1,002.3	33.2	51.0	123.5	87.7	39.0	10.0	363.0	12.0	7,350.0

[1] From press reports.
[2] No damage reported.
[3] Occurred in sparsely settled region: small damage.
[4] More than this number injured, but no definite figures obtained.
[5] Losses incurred amounting to several thousand dollars, definite estimate not obtained.
[6] No details of one tornado.
[7] Many more received medical attention, but no definite figures obtained.
[8] Additional losses of several hundred dollars, definite estimate not obtained.
[9] Small losses incurred.
[10] Additional losses of several thousand dollars, definite estimate not obtained.
[11] Several injured, definite figures not obtained.
[12] Traversed range land, no property loss.
[13] Occurred in unoccupied area, no property loss.
[14] Losses amounted to several hundred dollars, definite estimate not obtained.
[15] See references in monthly columns.

TABLE 2.—*Tornadic winds and possible tornadoes*

State	January	February	March	April	May	June	July	August	September	October	November	December	Year
Alabama:													
Number	0	1	0	0	0	0	0	0	0	0	0	0	1
Deaths		0											0
Injuries		3											3
Damage ($×1,000)		2.5											2.5
Iowa:													
Number	0	0	0	0	0	0	1	0	0	0	0	0	1
Deaths							0						0
Injuries							0						0
Damage ($×1,000)							12.0						12.0
Kansas:													
Number	0	0	0	1	0	0	[1] 1	1	0	0	0	0	3
Deaths				0			0	0					0
Injuries				0			0	0					0
Damage ($×1,000)				10.0			([2])	3.0					[3] 13.0
Louisiana:													
Number	0	0	1	0	0	0	0	0	0	0	0	0	1
Deaths			10										10
Injuries			[4] 50										[3] 50
Damage ($×1,000)			2,000.0										2,000.0
Michigan:													
Number	0	0	0	0	1	0	0	0	0	0	0	0	1
Deaths					0								0
Injuries					0								0
Damage ($×1,000)					100.0								100.0
Oklahoma:													
Number	0	0	0	0	1	0	0	0	0	0	0	0	1
Deaths					0								0

TABLE 2.—*Tornadic winds and possible tornadoes*—Continued

State	January	February	March	April	May	June	July	August	September	October	November	December	Year
Oklahoma—Con.													
Injuries					([5])								([3])
Damage ($×1,000)					([6])								([3])
Texas:													
Number	0	0	0	0	0	0	0	0	0	[7] 1	0	0	1
Deaths										0			0
Injuries										0			0
Damage ($×1,000)										([2])			([3])
Virginia:													
Number	0	0	0	0	0	0	0	1	0	0	0	0	1
Deaths								0					0
Injuries								0					0
Damage ($×1,000)								([5])					([3])
United States:													
Number		1	1	1	2		2	2		1			10
Deaths			10										10
Injuries		3	50										53
Damage ($×1,000)		2.5	2,000.0	10.0	100.0		12.0	3.0					2,127.5

[1] Did not reach ground.
[2] No damage.
[3] See references in monthly columns.
[4] More than this number injured, no definite figure obtained.
[5] Several persons inuured, no definite figures obtained.
[6] *Losses of several hundred dollars, no definite estimate obtained.*
[7] From press reports.
[8] Loss of several thousand dollars, no definite estimate obtained.

THE WEATHER OF 1940 IN THE UNITED STATES

By W. W. REED

[Weather Bureau, Washington, D. C., March 1, 1941]

On the basis of weighted averages for the several sections, the year 1940 was normal as to mean temperature; the value for the year was 53.6°, as compared with a mean of 53.7° for the period 1891 to 1940, inclusive, and the extremes of 55.6° in 1921 and 51.8° in 1917. The largest positive departures from section normal mean annual temperatures (Table 1) were +2.8° in Nevada, +2.4° in Washington and Idaho, and +2.2° in Utah; while the extremes on the negative side were −2.2° in Mississippi, −2.1° in Arkansas and −2.0° in Louisiana.

The monthly extremes of positive anomalies occurred in October with values of +6.8° for North Dakota, +6.7° for South Dakota and +6.6° for Nebraska, while the greatest negative departure came in January as follows: Missouri, −15.2°; Kentucky, −14.7°; Kansas, −14.6°; and Mississippi, −14.5°. This was the coldest January of record in large areas. In Central, Southern, and Eastern States the outstanding abnormal characteristic was the persistence of cold weather with but little variation from day to day, rather than extremely low individual temperature readings. (Weekly Weather and Crop Bulletin, February 6.)

Maximum temperatures of 120° or above were recorded in California, Arizona, and Nevada with highest readings: Greenland Ranch, Inyo County, Calif., 124° on August 11, 123° on July 24, and 122° on June 14; Cow Creek, Inyo County, Calif., 123° on July 24 and August 11, and 122° on June 15; and Parker Reservoir, San Bernardino County, Calif., 121° on August 11. Maximum temperatures of 100° or above were registered in all States outside New England, where the highest reading was 98° at Brockton, Mass., on July 27.

Subzero temperatures were reported from all States except Florida, with minima on January 19, when Fraser, Grand County, Colorado, reported −47° and Bedford, Lincoln County, Wyoming, −45°. The extremes of 124° and −47° registered for 1940 fell well within the range of the record extremes of 134° at Greenland Ranch, Death Valley, Calif., on July 10, 1913, and −66° at Riverside Ranger Station, Yellowstone National Park, Wyoming, on February 9, 1933.

In Florida, state-wide minimum temperatures were considerably below freezing (27° or lower) in all months from January to April, inclusive, and also in November and December, with the lowest 8° at Mason, Escambia County on January 27. Freezing temperatures were not registered in extreme Southern Florida—minima: Key West, 43°; Tavernier, 36°; Captiva, 34°; and West Palm Beach, 33°.

In general review the outstanding features of temperature distribution were (1) the very extensive area with decidedly subnormal means in January, with the large departures for Missouri and other States already noted, reaching westward to the Plateau Region, (2) the contrast between deficiencies in the East and excesses in the West from March to May, inclusive, and again in September, (3) the wide extent of supernormal averages in February, and June to August, inclusive, and especially in December when negative departures were recorded only from Portland, Maine northwestward, and (4), in marked contrast to all other months except January and April, subnormal means for November in the West with deficiencies averaging more than 4° from Minnesota to Idaho, with an extreme of −6.9° in Montana.

Table 1 and the Chart of Annual Temperature Departures supplement these general remarks.

The average annual precipitation, derived by weighting the averages for the varying areas of the several States, was 30.25 inches or 1.25 inches above the similarly determined mean for the period 1886 to 1940, inclusive, in which the extreme means were 32.74 inches in 1915 and 24.65 inches in 1910.

Figure 1 and table 2 show precipitation at or above normal over all except 14 States from South Dakota to the South Atlantic States, with percentage highest in California (152), next highest in Louisiana (134), and third highest in Idaho, Nevada, Arizona, and Utah (127 to 123). The States with percentage of normal yearly precipitation below 85 were Indiana (83), Missouri (81), South Dakota (79), Illinois (77), and Nebraska (74), two of which, South Dakota and Nebraska, were classified

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